

REMARKS

Claims 10, 17, and 20-26 remain pending. Claims 10 and 21 are independent.

Rejection Under 35 U.S.C. § 103(a) over Aoyagi et al. in View of Arnold et al. and Lahiff

Claims 10, 17, and 20-26 stand rejected as unpatentable over Aoyagi et al., U.S Patent Application Publication 2002/0172847 in view of Arnold et al., U.S. Patent No. 6,647,724 and Lahiff, U.S Patent Application Publication 2003/0068538. Applicants respectfully traverse the rejection and request reconsideration of the claims.

The combined references do not disclose a fuel cell system

The Aoyagi patent teaches, as the Office Action says, a variable capacity compressor for delivering air to a fuel cell and that the a capacitor connected in parallel with the fuel cell is charged by the fuel cell. The Aoyagi patent teaches that the electricity generated by the fuel cell supplies the load, and the capacitor also supplies the load “when the target supply current increases within a time shorter than a response delay which is caused in the fuel cell while the fuel cell control means control an output current of the fuel cell, and the output current of the fuel cell is smaller than the current demanded by the load.” Para. [0008]. The load is a power drive unit 6, an air-conditioner 7, and a 12-V load 9 (referring to elements of Fig. 1). Para. [0026]. The fuel cell charges the capacitor “[i]f the response delay is caused when the target supply current is reduced and the current supplied from the fuel cell becomes excessive.” Para. [0010]. The capacitor, as already mentioned, supplies the load when there is current shortfall from the fuel cell.

The Aoyagi patent fails to teach or provide a reason for including a controller that monitors a power demand from the fuel cell and that selects a power source for the compressor

motor from a main power source and a supplemental power source. The Aoyagi patent also fails to teach or provide a reason for basing this selection on whether the compressor motor is operating in a normal mode or in a rapid transient mode. The Aoyagi patent further fails to teach or provide a reason to use a capacitor or supercapacitor as a supplemental power source for the *compressor motor*, as the Aoyagi patent nowhere suggests any kind of supplemental power source for its compressor. The Aoyagi patent additionally fails to teach or provide a reason for providing a controller that controls charging of the supplemental power source. Finally, the Aoyagi patent fails to teach or provide a reason for including in this charging of a supplemental compressor motor power source regenerative braking of the fuel cell compressor motor that converts mechanical energy into charging current.

The Office Action cites the Arnold patent as teaching a variable speed compressor, but Applicants respectfully point out that this is not quite correct. While in some sense every compressor can be “variable speed” because the shaft (e.g., shaft 252 of Fig. 2) can be made to rotate more or less quickly, the Arnold boost/generation system (e.g., boost/generation system 220 of Fig. 2) does not have Applicant’s invention’s features of controller and variable capacity compressor system operating in a normal mode with a main power source and a rapid upward transient mode with a supplemental power source. In contrast with Applicant’s system, the Arnold boost/generation system only operates in on and off modes: “[A]n increase in demand and/or fuel flow occurs at a time of approximately t_0 . In response to the increase in demand and/or fuel flow, a controller (e.g., the electric control unit 260 of FIG. 2) provides power to an electric compressor unit (e.g., the electric compressor unit 240 of FIG. 2). In turn, the electric compressor unit drives a shaft (e.g., shaft 242 of FIG. 2) operatively coupled to a compressor (e.g., the compressor 224 of FIG. 2) to thereby boost air pressure and hence air flow to an

internal combustion engine (e.g., internal combustion engine 110 of FIG. 2).” Col. 4, ll. 26-36. See also col. 5, l. 64 to col. 6, l. 20 (boost/generation system operates on intermittently, only on when a boost is needed). The Arnold patent teaches that its compressor is only operated for only “a few second or so,” col. 5, ll. 64-65 and “each burst does not exceed approximately 10 seconds,” col. 6, l. 2-3.

The Aoyagi fuel cell system could not be modified by substituting the Arnold boost/generation system because it would just completely stop working. The Aoyagi fuel cell system requires continual operation of its air compressor to work. When the compressor is off, the fuel cell will not produce current and the car will not go. This is not a problem in the Arnold engine because the Arnold engine is an I/C engine that does not rely on the compressor for air. The argument in rejection is that “[i]t would be desirable to use the compressor of Arnold et al. in the system of Aoyagi et al. since the rapid transient modes of Arnold et al. would provide greater bursts of air to the fuel cell system” but the Aoyagi fuel cell simply cannot operate without air, as would happen between those Arnold “bursts of air.” The Arnold patent boost/generation system simply can’t work in the Aoyagi fuel cell system. As the Office Action itself points out on page 4, the amount of power produced by the fuel cell is influenced by the amount of air provided to the fuel cell. No air, no power. Ten second bursts of air, 10 seconds of power.

The Examiner’s attention is once again respectfully drawn to the Declaration of Joseph D. Rainville Under 37 C.F.R. § 1.132, who is an expert in this field. As discussed by Mr. Rainville, the Arnold patent only concerns turbocharging an internal combustion engine. The Arnold turbocharger uses its compressor intermittently to provide bursts of power. The Arnold patent does not describe a compressor that is powered in a normal mode with a main power

source and in a rapid transient mode with a supplemental power source. Further, the Arnold turbocharger requires a turbine power source, which would not appear to be compatible with the Aoyagi patent fuel cell system.

Thus, the Rainville Declaration is further evidence that the skilled artisan would neither interpret nor apply the Arnold patent in the way the Office Action argument has done.

Nor do the combined references teach, suggest, or provide any basis for Applicants' inspiration to maintain a supplemental power source at least in part by recapturing energy from the very compressor that it powers in an upward rapid transient mode. The Aoyagi charges its 12-V load with the fuel cell. The Arnold reference teaches recharging its capacitor via an electric turbine that captures energy from engine exhaust; this method is unavailable in the Aoyagi system. Finally, the Lahiff publication (as described by an experienced artisan in the field, Mr. Rainville, in his Declaration) uses its fuel cell compressor to dissipate ("waste") excess electrical power. This is quite the opposite of the intentional energy conservation basis of the present invention in recovering energy from the fuel cell compressor. The Lahiff publication teaches away from Applicants' invention, and thus does not make Applicants' invention obvious. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, *or would be led in a direction divergent from the path that was taken by the applicant.*" *Optivus Tech., Inc. v. Ion Beam Applications S.A.*, 469 F.3d 978, 989 (Fed. Cir. 2006) (quoting *In re Kahn*, 441 F.3d 977, 990 (Fed. Cir. 2006)) (emphasis added). The skilled artisan would simply not turn to the Lahiff publication in the first place for a method of conserving the energy of the system; there

would be not expectation of a successful modification based on Lahiff's intentional energy dissipation.

Still yet, nothing in the combined references teaches using the same supplemental power source charged by regeneratively braking the compressor to power the compressor in a rapid upward transient mode.

Because of these deficiencies of the combined references cited in rejection, reconsideration and allowance of the claims are thus respectfully requested.

Conclusion

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,



Anna M. Budde
Registration No. 35,085

September 4, 2009
Harness, Dickey & Pierce, P.L.C.
P.O. Box 828
Bloomfield Hills, Michigan 48303
(248) 641-1600